THE OFFICE OF THE STATE CHIEF INFORMATION OFFICER
ENTERPRISE TECHNOLOGY STRATEGIES

North Carolina Statewide Technical Architecture

Domain White Paper

Enterprise Management Architecture
Technology Overview

STATEWIDE TECHNICAL ARCHITECTURE

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Enterprise Management Architecture Technology Overview

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Office of the State Chief Information Officer
Enterprise Technology Strategies
PO Box 17209
Raleigh, North Carolina 27699-7209
Telephone (919) 981-5510
ets@ncmail.net

Mission Statement

Enterprise Management Architecture defines the framework for efficient and effective management of the state's distributed information processing environment in order to support and enhance the productivity of its automated business systems.

The state's Enterprise Management Architecture is the framework that identifies the requirements for managing and supporting the enterprise-wide technical architecture with primary emphasis on centrally managing distributed systems at geographically disbursed sites. Resources managed include the systems, databases, applications, networks, and Internet components necessary to conduct the automated business functions of the state.

Currently, most North Carolina agency mainframe computer operations, hosting a variety of legacy systems, are consolidated into a single centralized computer operation. This `glass house' environment, developed to support large mainframes, provides management with a single control point for user access, production operations, and enterprise data. Comprehensive enterprise management disciplines, standards, practices, and tools are well defined for mainframe computing, with a long history of successful use.

The rapid advances in desktop and local server based computing in recent years have led to a multitude of PC, LAN and WAN configurations deployed locally to meet specific computing needs. User preference for PCs with a GUI interface has led to the transition of mission critical applications from the secure mainframe `glass house' environment to the less secure workplace. This has greatly increased the complexity and challenges of enterprise management for distributed computing. Unlike mainframe computing, which has developed reliable tools and practices over the years, distributed enterprise management tools are in the formative stage of their life cycle. Vendors are investing in developing and enhancing their enterprise management products. They are building integrated suites of products to manage complex environments, developing relationships with other vendors, and building enterprise management functionality into their products. Point product solutions are available for specific enterprise management functions. However, fully

integrated enterprise management product suites are not predicted to achieve market maturity until 1998 or later.

To meet the challenges of the distributed information processing environment, it is necessary to make the successful transition from host-based to distributed systems management (DSM). Standards and procedures are being developed that will support all mission critical client/server applications regardless of where they reside. Enterprise management applies the appropriate standards, practices, procedures and tools to all types of computing environments, enables the state to maximize the use of its information processing resources and enhances the accessibility, timeliness, and quality of service to its citizens.

The existence of a common uniform network (see the "*Network Architecture Chapter*") provides the backbone that permits the state to benefit from the centralized management of certain distributed computing functions. The centralized management techniques, currently used for mainframe applications, create building blocks of skills and experience that can be applied to the distributed information processing environment. Mainframe management concepts, including enterprise data, controlled user access, and production disciplines, are effective, reliable and readily adaptable to the distributed computing environment. The Enterprise Management Architecture seeks to leverage the proven mainframe concepts to develop a framework of practices, technology and tools to support the management of mission critical, distributed client/server applications and technological resources.

Enterprise management can be subdivided into many disciplines. Six important disciplines are listed below. (See Figure 11-1.) Two of these disciplines will be discussed in this chapter as Technical Topics (Help Desk and Operations Management), the others will be addressed in a future edition the Statewide Technical Architecture as either separate chapters or chapter components.)

- ***Help Desk***. An integrated support services structure that forms the hub for effectively using and deploying technical enterprise management components. The support services center becomes the central collection point for client contact and control of the problem, change and service management processes. (See Technical Topic *"Help Desk"* in this chapter.)
- ***Operations Management***. Encompasses the coordination of system and network resources throughout the enterprise. Its goal is to provide reliable availability for mission critical systems. It includes job scheduling to coordinate jobs and processes in the distributed environment, fault/event management, configuration management, backup and recovery and automated software distribution. (See Technical Topic *"Operations Management"* in this chapter.)

- ***Storage Management***. Governs the creation, maintenance and retention of data, including tape and disk management processes. (See Technical Topic*"Storage Management"* in a future edition of this chapter.)
- ***Performance Monitoring and Tuning***. Performance monitoring measures, evaluates and records status information about computer system devices and processes. Tuning applies planned system modifications in order to improve performance. Performance affects how fast and/or how much data is processed. (See Technical Topic *"Performance Monitoring and Tuning"* in a future edition of this chapter.)
- ***Security Services***. Risk assessment and protection of the physical, intellectual and electronic assets of an enterprise, including security policies, network access, virus protection, firewalls, NOS administration and workstation security. (See Security and Directory Services Chapter in the Statewide Technical Architecture document.)
- ***Disaster Recovery***. Recovery plans and technology that insure the continued operation of critical business functions when productivity is threatened by unforeseen circumstances. (See Technical Topic *"Disaster Recovery"* in a future edition of this chapter.)

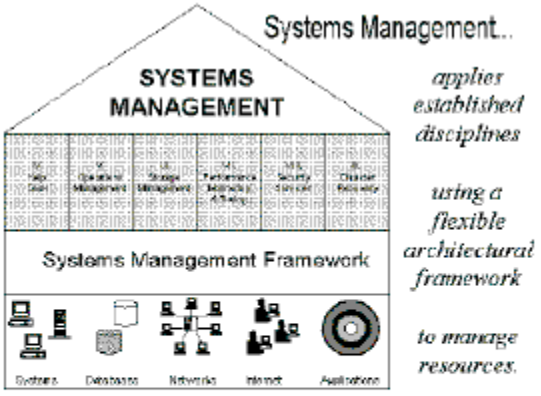

Figure 11-1. Distributed Enterprise Management Architecture

The technical architecture for distributed enterprise management must be implemented using a broad framework that is driven by business goals and adapts to technology advances to achieve ever-changing business objectives. It affects business opportunities, organizational issues, product and vendor selection and technology deployment strategies.

Technical Topics

Help Desk

Introduction

The migration from mainframe host-based systems to distributed systems has dramatically increased the complexity of the state's business environment. Technological advances, including desktops, laptops, LANs, WANs, office automation, internet, remote virtual office access, decision support systems, and e-mail/groupware, offer many new opportunities for improving the state's business processes and providing increased citizen interaction with government. However, the variety of new technology options also increases user frustration and heightens demand for quality support. *One of the most important Enterprise management Architecture components is the help desk*. It must be designed as a customer-oriented business driven service center. A strong help desk structure provides the user support necessary to build and sustain a modern computing environment.

Prior to 1990, the traditional help desk existed to support mainframe computing. It was a front-end support organization for mainframe applications. The help desk was part of a larger technical organization geared to support mainframe operations by fixing technical problems onsite. Its focus was reactive. Staff waited for users to call with problems, which were logged and dispatched. First level help desk employees were trained to perform only the most basic operations (reset passwords etc.). For more complex calls, the help desk was a `pass through' or entry point to obtaining service. A problem was identified and channeled to the appropriate technician, who worked on the defect and fixed it in the centralized data center (i.e., glass house). The technician fixing the problem had very little, if any, contact with the caller. The job objective was to support the mainframe operation, not the user's business. Most help desk positions were entry level. Many help desk applications were simple, non-integrated, home grown problem recording systems. Operational metrics were collected which basically counted the number and type of calls. This traditional help desk as problem collector and dispatcher led to the user perception of the `helpless help desk'.

In the early 1990's, the service driven help desk evolved as a response to the increasing complexity of the distributed computing environment. It is focused on user support and driven by the business process. Client/server architectures are easier than the mainframe for the average user to understand and operate; therefore client/server systems are used more and customer expectations are higher. However, the many integrated components of client/server systems make it much more difficult for the average user to diagnose and solve his own problems. A customer should not have to determine if his problem is an application, network and/or hardware problem and decide where to go for assistance. A centralized help desk provides a single point of contact, SPOC (one number to call), which automatically routes the service request to the appropriate resource.

The growth of disparate and departmentalized client/server systems has increased the complexities of IT enterprise management. The evolution of the help desk into an automated service desk is an outgrowth of IT management's response to user support requests.

- The modern service driven help desk:
- Is driven by business needs.
- Centers on customer service.
- Is staffed by career professionals.
- Uses state-of-the-art automated tools to record and track user requests for service.
- Builds knowledge bases of solutions to common problems.
- Empowers both support staff and customers.
- Fosters communication by sharing data and transferring requests among geographically disbursed locations.
- Collects and uses sophisticated metrics to avoid recurring problems.
- Performs the problem and resolution management functions.
- Integrates with many other support functions including change, service, operations, asset management, training, installation, and maintenance services.
- Uses a process-oriented approach to link business needs with technology management. Figure 11-2 illustrates how the various end user support processes are centered on the end users needs and integrated to support the business needs.

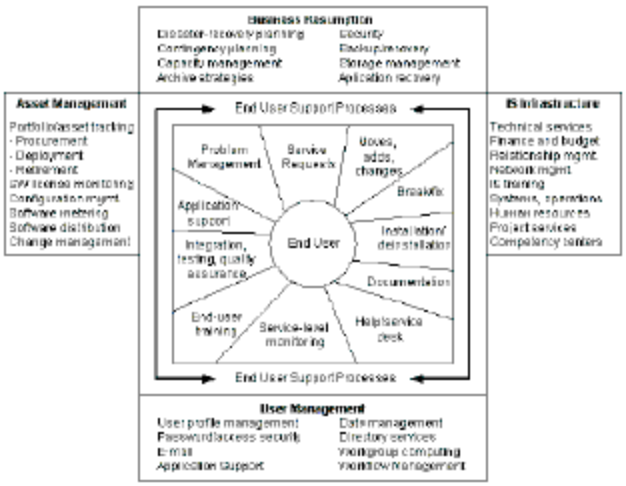

Figure 11-2. Linking Process Groups By Their Shared Information

The new help desk is the cornerstone of the enterprises virtual client/server management infrastructure. The help desk, which leads the way toward the year 2000, uses technology wisely to expand into a fully operational support center. Its mission is to enable productivity.

The Help Desk component of the Enterprise management Architecture supports the ability of all help desks in the state to maintain their own help desk database and to access and share an enterprise-wide database of client, request, and resolution information. This sharing of information enables the state to more efficiently identify and resolve user problems. It builds on and improves the internal efficiencies of departments. In Figure 11-3 Agency A operates a help desk application of its choice while Agency B has chosen to participate in the SIPS Client Support System (CSS). Data is periodically extracted from all agency help desk databases, including the SIPS CSS, and placed in an enterprise-wide database which can be used by all help desk units in the state.

Technology Components

The following technology components have been identified as necessary for the successful implementation of the help desk discipline.

Network and Operating Platform

An operating environment using client/server platforms and network components, including LANs and WANs, forms the basis for meeting the challenges to support decentralized resources from central locations. It enables shared information among state agencies. (S*ee also* Platform Architecture *and* Network Architecture.)

Integrated Communications Infrastructure

An integrated communications infrastructure supports the help desk functions by providing timely services to remote locations. Some examples of voice and data communications tools necessary and the services they support are listed in Figure 11-4.

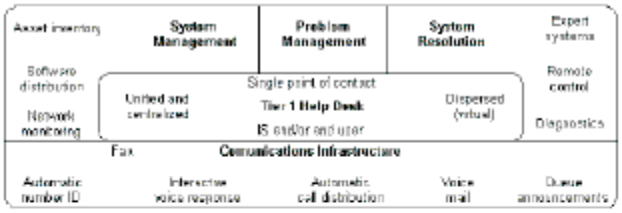

Figure 11-4. Service Desk Tools Infrastructure

Help Desk Applications Software

Client/server based help desk applications and related software packages are necessary to support help desk business functions. These applications record and track events, automate event queue and event escalation, support development of event history and resolution knowledge bases, facilitate reporting, and promote integration with other support functions such as change and service management.

Web Browsers

Web browsers permit access to the customer support database to request services, research resolutions, and monitor service request progress

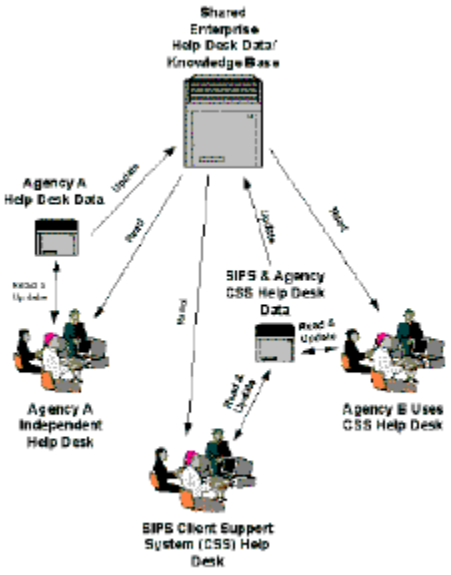

Figure 11-3. Shared Data Links Agency Help Desks

Note that the same help desk architecture linking internal agency help desks can be applied to establishing a highly effective help desk to respond directly to citizen requests for service. This architecture ensures that the public can access and use state services and information quickly and easily through a single contact.

Operations Management

Introduction

Encompasses the coordination of system and network resources throughout the enterprise. Its goal is to provide reliable availability for mission critical systems. It includes job scheduling to coordinate jobs and processes in the distributed environment, fault/event management, configuration management, backup and recovery and automated software distribution.

Enterprise management of operations in a distributed computing environment is much more complex than in the mainframe environment. Client/server systems are composed of computer nodes, networks and applications. These three elements are logically integrated but they can be physically dispersed. The level of complexity escalates when the various components are heterogeneous. The reliability of a distributed system is dependent on the reliability of each component.

Reliable availability for mission critical applications is the primary operational objective. Operations management encompasses the coordination of system and network resources throughout the enterprise. Its goal is reliable system availability which can mean 24 hours per day/ 7 days per week for some applications.

In the early stages of client/server, vendors supplied tools to manage their individual products; however there were no standards or tools that addressed the interrelationships of the various products. This made it extremely difficult to correctly diagnose and resolve system problems, contributed to scheduling difficulties and caused network downtime. The need for integrated standards to manage the entire networked systems operation has been addressed by vendors in two ways. First, some vendors are providing product suites to manage many facets of entire distributed systems. Second, vendors have formed groups to define standards which promote integrated management of various components.

Standard protocols, such as the Simple Network Management Protocol, SNMP, permit the exchange of management information among heterogeneous or multi-vendor network components (hardware and software). Management workstations run agents to manage each network component. These agents reside on managed entities, continually report on their status, and execute commands. Real-time data is collected and stored by the agents on the nodes they manage in management information bases or MIBs. A MIB is a structured collection of information concerning a managed resource. Each node on the network maintains a MIB reflecting the managed resource's status at any given time.

Figure 11-6 illustrates the SNMP management process. The SNMP manager requests information by constantly `polling' the devices it manages. The SNMP

agent, which is located on the managed device, processes requests by reading information from or writing information to the MIB. The agent information is sent back to the manager, allowing it to construct a view of the managed devices. When there is a problem an SNMP `trap' or alert is sent back to the manager. Traps direct the manager's attention to problems and enable it to notify network administration that corrective action is needed.

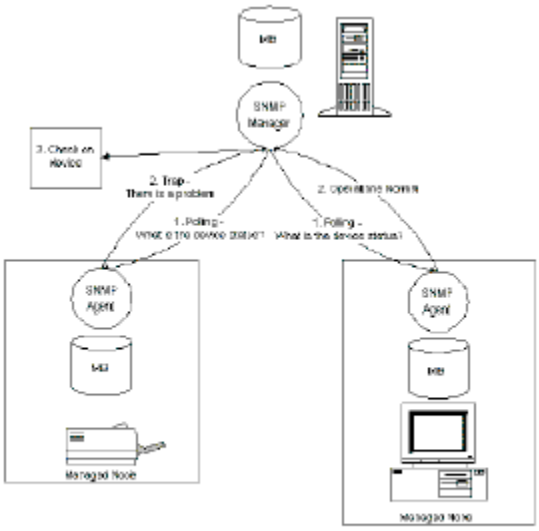

Figure 11-6. SNMP Manager/Agent Structure

Network Management Platforms (NMP) monitor nodes by reading the value of managed resources in the MIB. NMP can effect changes in the managed resources by altering MIB values. Management workstations gather the information provided by the agents and store it in a central database. The management workstations create views of the network which represent the status of managed entities and visually present them to the world through the user interface.

Configuration management is used to define consistent products and enforce operational policies and procedures. The virtual data center (VDC) concept uses consistent network configurations locally deployed near the users they serve, yet managed from a central location. Network configurations are deployed at business locations and secured in closet type environments (i.e. `glass closets'). Servers locked in closets at remote sites are accessed and managed centrally from remote locations. This concept maintains high reliability and availability, while providing

technical service at a lower cost. Centralization, standardization and remote management of virtual data centers encourages economies of scale.

In order to implement a VDC, it is important to define the scope of production control. The number and types of services provided remotely and locally must be established and documented in a service level agreement, SLA. Figure 11-7 shows the centrally managed and monitored production components in the circle. The diagram uses the hub as the cutoff point for centralized enterprise management delivery. The hub is centrally managed and provides access to the network by appropriate equipment. In a complete implementation of VDC, both the file server and all application servers are centrally managed and would be depicted within the circle of the diagram. However, many enterprises have deployed local file servers and application servers as shown outside the circle in the diagram. As operations management is able to offer more reliable and comprehensive services, the management of these local servers migrates to the VDC under provisions of service level agreements. During the transition period, local management and central management coexist within the enterprise in the context of the strategic management program. In both cases, the customer is responsible for `pulling' information from the file transfer protocol, FTP, server to upgrade software used on the desktop. As enterprise management standards and tools become more sophisticated, it becomes possible to extend the remotely controlled scope of production to include customer components at the desktop.

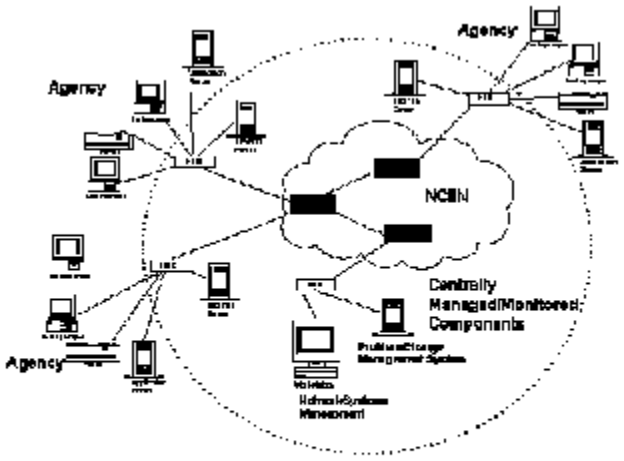

Figure 11- 7. Scope of Production

This enterprise management architecture provides the guidelines for managing the reliable enterprise-wide operation of mission critical applications.

Technology Components

The following technology components have been identified as necessary for the successful implementation of the operations management discipline.

User Interface for Operations Staff

The user interface for operations staff visually represents managed objects and tracks agents on the network. Iconic images of the real world represent the devices, location and status of the network environment. Event/action combinations are visually defined. Clicking on a icon shows a managed objects current state and options for its control. Objects represent management functions and support views of business process functions. Visual representations create a mirror world and permit a virtual roaming through the network. Query dialogs are provided to view information in the management database. Tree views present agent information on MIB status.

Management Applications

Management applications perform enterprise management functions including operations, scheduling, configuration, problem, change and asset management. They collect real-time information from the system components. These applications continuously monitor the system for potential problems and automatically launch corrective or preventative actions. They communicate with agents and other enterprise management components through high-level application interfaces, APIs. A network enterprise management, NSM, framework is vendor provided middleware that integrates multiple management applications through the use of collective services accessed through API's. There currently is no single framework standard that integrates all managed components. It is predicted that more advanced management frameworks will become available in 1998. In an attempt to integrate management functions, vendors are providing product suites. No single product suite addresses all management functions, however use of a suite provides some level of product integration.

Management Information Database

The management information database is composed of information collected from the agents under the control of managing workstations. It is currently implemented

using a relational database management system, RDBMS. An object database management system, ODBMS is an emerging technology which uses the Common Object Request Broker Architecture, CORBA. ODBMS technology may have future potential for management information application databases. *(See the Componentware Architecture Chapter.)* Agents reside on the different managed network entities and continuously report on their status. Managing workstations can locate software agents anywhere on the network to gather management data and trigger responses to events. Real-time management data is maintained by the agents and stored on the local nodes they manage called management information bases (MIBs).

Figure 11-8 summarizes the enterprise management technology components and their relationships.

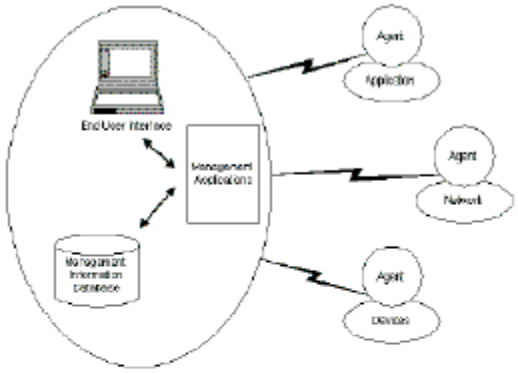

Figure 11-8. Enterprise management Technology Components